

## A Note on the Derivation of the Odonate Fauna of the Island of Ceylon

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Ceylon is separated from the Indian mainland by a narrow strait barely 50 miles wide, and nowhere more than about 10 fathoms deep; partly bridged moreover by shoals and islands which form the well-known "Adam's Bridge." The northern part of the island is low-lying, the south-central area mountainous, the hills rising to a height of over 7000 ft. The plains are covered with savannah, the mountains carry a dense rain-forest. Both plains and mountains are of course now-a-days largely under cultivation.

Zoologically, the island is a Province of the Indian Subregion (roughly the lands lying to the south of the great valleys of the Indus and Ganges), and its fauna differs from that of the mainland (Indian) Province to a considerable extent. On the one hand some of the characteristic Oriental forms found in India are lacking in Ceylon, the tiger is a familiar example; on the other Ceylon is occupied by several groups which are not found on the mainland. The Acavidae, a family of pulmonate land-mollusca, related to forms from the Seychelles and Madagascar, may serve as an instance. The dragonflies of these two Provinces show interesting differences, with which this note is concerned.

The Indian Subregion differs from the other Subregions of the Oriental Region briefly as follows:

Of the Zygoptera, the *Megapodagriidae* are absent, as are the *Platyncnemidae* (except for the ubiquitous genus *Copea*); the *Chlorocyphidae* are poorly represented. Amongst the Anisoptera the Aeschnidae have relatively few species and no endemic genus. Some genera of the *Gomphidae* and of the *Libellulidae* otherwise widely distributed in the Region are not represented; one may quote *Sieboldius* and *Lyriothemis* as examples.

Both Provinces have special positive characters of their own. India has a radiation of 10 species of the Corduline sub-family *Idionychinae*, of 6 species of *Protosticta*, and of about 12 species belonging to the *Protoncuridae*, referred by FRASER to five endemic genera. The Epallagid genus *Indophaca* has three species remotely allied to a Malaysian form; *Chlorogomphus* has 2 endemic species. None of these have been found in Ceylon. The only Subregional endemic genus shared by the two Provinces is *Platysticta* with which I deal below. This genus has two species in Ceylon, and one very distinct species in the extreme South of India.

The endemic Indian species are found mainly in the Western Ghats, the long mountain range which runs for nearly 800 miles from north to south along the west coast of the Indian Peninsula, reaching a height of over 7000 ft. in the Nilgiri and Anaimallai Hills. The range is largely covered with rain-forest, and is broken here and there by "gaps." Of these the Palghat gap which separates the Nilgiris from the Anaimallai Hills is the most important. Isolation of the forest-dwelling dragonflies in the several "sections" of the range has been sufficient to allow of some differentiation of the fauna of each of them. Thus *Chlorogomphus campioni* Fraser and *Indiophaca dispar* Rambur are found north of the Palghat gap only, whilst *Chlorogomphus xanthoptera* Fraser and *Indophaca fraseri* Laidlaw are restricted to the hills to the South. The Ghats may in fact be looked on as a chain of islands of forest and mountain separated from each other by a "sea" of low-lying, somewhat arid country; and Ceylon may be likewise regarded as a similar but more isolated island. The Ceylonese mountains are about 200 miles distant from the nearest hills of India.

The number of species of dragonflies recorded from Ceylon is 100, allowing for a few doubtful entries. I have listed them below in three categories as follows:

- I. Species found in India, and in many cases with a wide distribution through the Oriental Region.

*Neurobasis chinensis* Linne.

*Lestes clata* Selys.

*Lestes praemorsa* Selys (= *decipiens* Kirby).  
*Copera marginipes* Rambur.  
*Ceragrion cerinorubellum* Rambur.  
*Ceragrion coromandelianum* Fabricius.  
*Aciagrion hisopa* Selys.  
*Aciagrion occidentale* Laidlaw.  
*Pseudagrion microcephalum* Rambur.  
*Pseudagrion malabaricum* Fraser.  
*Enallagma malayanum* Selys.  
*Enallagma partium* Selys.  
*Ichnura senegalensis* Rambur.  
*Ichnura delicata* Hagen (= *aurora* Brauer).  
*Agriocnemis pygmaea* Rambur.  
*Agriocnemis femina* Brauer.  
*Ictinogomphus rapax* Rambur.  
*Anax immaculifrons* Rambur.  
*Anax guttatus* Burmeister.  
*Hemianax cphippiger* Burmeister.  
*Gynacantha hyalina* Selys.  
*Cratilla lineata* Brauer.  
*Lathrecista asiatica* Fabricius.  
*Potamarcha obscura* Rambur.  
*Orthetrum pruinatum neglectum* Rambur.  
*Orthetrum chrysostigma luzonicum* Brauer.  
*Orthetrum glaucum* Brauer.  
*Orthetrum triangulare triangulare* Selys.  
*Orthetrum sabina* Drury.  
*Orthetrum chrysis* Selys.  
*Brachydiplax sobrina* Rambur.  
*Diplacodes trivialis* Rambur.  
*Diplacodes nebulosa* Fabricius.  
*Acisoma panorpoides* Rambur.  
*Crocothemis servilia* Drury.  
*Bradinopyga geminata* Rambur.  
*Neurothemis tullia* Drury.  
*Neurothemis intermedia intermedia* Rambur.  
*Rhodothemis rufa* Rambur.  
*Sympetrum fonscolombi* Selys.  
*Trithemis kirbyi kirbyi* Selys.  
*Trithemis aurora* Burmeister.  
*Trithemis pallidinervis* Kirby.  
*Trithemis festiva* Rambur.  
*Tholymis tillarga* Fabricius.  
*Pantala flavescens* Fabricius.  
*Tramea basilaris burmeisteri* Kirby.

*Tramca limbata* Desjardins.  
*Hydrobasileus croceus* Brauer.  
*Zyxomma petiolatum* Rambur.  
*Rhyothemis variegata* Linne.  
*Rhyothemis triangularis* Kirby.  
*Urothemis signata* Rambur.  
*Macrodiplax cora* Brauer.  
*Aethriamanta brevipennis* Rambur.

Ceylon shares with S. India *Hylaeothemis fruhstorferi* Karsch. This genus has one other species in Borneo, and one in the N. W. Himalaya.

It also shares a subspecies *Sita* Champion of *Indothemis limbata* Selys, the nominate species is found in Lower Burma and Malaya.

I have recorded an unidentified species of *Mortonagrion* from the island (LAIDLAW 1924). FRASER (1936) thinks that the record of *Aethriamanta brevipennis* is due to an error. He also suggests that *Hemicordulia asiatica* Selys. and *Neurothemis fulvia* Drury will be added to the list.

II. Representative species, presumably derived from the same stock as existing Indian species.

*Vestalis (Vestinus) apicalis nigrescens* Fraser.  
*Pseudagrion rubriceps ceylonicum* Kirby.  
*Paragomphus henryi* Laidlaw.  
*Cyclogomphus gynostylus* Fraser.  
*Burmagomphus pyramidalis sinuatus* Fraser.  
*Megalogomphus ceylonicus* Laidlaw.  
*Microgomphus lankanensis* Fraser.  
*Heliogomphus nictneri* Selys.  
*Heliogomphus lyratus* Fraser.  
*Heliogomphus ceylonicus* Selys.  
*Heliogomphus walli* Fraser.  
*Microgomphus wijaya* Lieftinck.  
*Gomphidia pearsoni* Fraser.  
*Epophthalmia vittata cyanocephala* Hagen.  
*Macromia ceylanica* Fraser.  
*Tetrathemis yerburyi* Kirby.  
*Zygonyx iris ceylonica* Kirby.  
*Onychothemis testacea ceylonica* Ris.

## III. Species which do not fall into either of the above categories.

*Euphaea splendens* Selys.

The nearest allies of this species are Malaysian forms such as *variegata* Rambur.

*Libellago* 4 sp.

A radiation of species perhaps resulting from the absence of competitor pressure. One of them, *indica* has, I believe, invaded the Indian mainland. It was first described by FRASER (1928) as a race of *lineata* from S. India, where it ranges as far north as Poona.

*Lestes* (?) *orientalis* Hagen.

This large species is quite unlike anything known from the Indian Province. FRASER tells me (in litt.) that it is probably generically distinct from true *Lestes* and may be near *Orolestes*, a genus which is known from the Himalaya, through Indochina to Malaysia.

*Lestes* (*Ceylonolestes*) *gracilis* Hagen.

*Lestes* (*Ceylonolestes*) *divisa* Selys.

These species belong to a section of the genus which is mainly characteristic of Indochina. A species closely allied to *gracilis* is however found in S. India to the south of the Palghat gap.

*Drepanosticta* (*Ceylonosticta*) 11 sp.

A radiation presumably also resulting from absence of competitor pressure. It is worth noting that a single species of *Drepanosticta* which is probably allied to the Ceylon forms is found in the Andaman Is. where too a *Libellago* occurs. *Drepanosticta* is not found in Peninsular India, it occurs in Assam, Burma, Malaysia, and further east.

*Platysticta* 2 sp.

Very distinct from any other Oriental genus. I believe it to be related to the genus *Palaemnema* of S. America. In discussion with FRASER he admits that this is possible though he had (1938) put the latter genus in a subfamily of its own. *Elatoneura* 3 sp.

The genus is found in India, and as far to the east as Malaysia. The Ceylon species are all very distinct, and do not suggest near relationship with other species.

*Prodasineura sita* Kirby.

Regarded by FRASER as related to *autumnalis* Fraser from Burma.

About 57% of the species are held in the *first category*. Two only of these, *Hylacothemis fruhstorferi* and *Indothemis* show

definite relationship with Indochinese or Malaysian stock. The remainder are almost all of them forms which live in low-lying country, often with a rather arid climate. Some of them are known to have migratory habits (e.g., *Sympetrum fonscolombei*), others have a very wide range, and probably all of them are capable of crossing from the mainland at the present time by way of Adam's Bridge either actively or passively.

The *second category*, 18% of the species, consists of forms whose opportunities of reaching the island have been few, perhaps unique. Most of them are forest dwellers, and many show the effects of prolonged isolation—marked differentiation from the parent stock. Rapid permeation of the stock has probably been helped in some cases by the relatively small area occupied by a species.

25% of the species fall into the *third category*. Twenty of these are definitely related to Burmese or Malayan forms. This specific percentage is exaggerated by the presence of the two radiations, *Libellago* and *Drepanosticta*. The three species of *Elattonenra* give little help to guide us in speculating as to their origin.

The two species of *Platysticta* (along with their Indian congener) are the most interesting members of the fauna. The genus is probably a surviving remnant of an ancient fauna which now has no other representatives in the area. Both S. India and Ceylon are believed to be very old land surfaces, and the survival in them of "palaeogenic" forms is quite possible.

The presence of the very definite Malaysian and Indochinese elements in the fauna of Ceylon, and to a lesser degree in that of S. India would involve at the present time a migration of roughly 1000 miles across the Bay of Bengal, or an equally lengthy journey in conditions unfavourable climatically, round the coast of the Bay.

Two suggestions have been made as to means which would make such a passage possible:

The first is that insects may be carried passively from time to time across the Bay by the N. E. Monsoon wind, which blows steadily and persistently across the bay from the north-east during the winter months.

Migration of this sort could only be a rare accident, and successful colonization very exceptional.

The species listed in the third category certainly suggest a random "selection." It will be noticed that all of them are Zygoptera and not strong fliers, it is possible that the possession of strong power of flight may make a passive migration less likely. Compare CALVERT'S (1942) notes on the fauna of the West Indian islands.

The second suggestion, which I owe to Prof. ZEUNER, is that there was a connection between Ceylon and the Indian mainland in Pleistocene times, and that great climatic fluctuations took place in that Period when it is possible that the "equatorial rain-belt lay a little further to the North than it does today. This may have enabled species to migrate round the coasts of the Gulf of Bengal."

To sum up. In addition to the ordinary lowland Oriental and Palaetropical fauna, about 57% of all its Odonata, Ceylon has about 18% of forms related to Indian species but differentiated more or less, by isolation.

The remainder for the most part show affinities to Burmese or Malayan forms, and it is suggested that such forms have reached Ceylon either as passive immigrants carried by seasonal (Monsoon) winds, or have travelled round the coasts of the Bay of Bengal in Pleistocene times, when physical and climatic conditions differed from those of today.

Lastly the Ceylon and Indian species of the genus *Platysticta* are regarded as *palaeogenic*, that is as survivals of a very ancient fauna.

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